Interview: Dr. Claude Touzet

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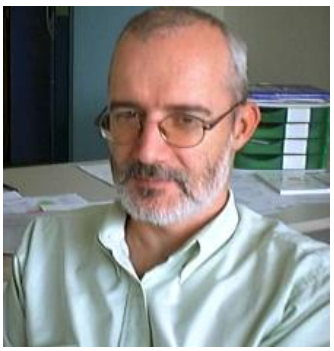

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Tell us something about yourself and could you briefly describe your career?

I am a French scientist, 40 years old, with a Master degree in Behavioural Neurosciences and a Doctoral degree in Computer Sciences. I started my career as a research assistant in an Engineering School in Nimes (France) in 1987. It was the coming back of the artificial neural networks and, with my thesis advisor Prof. N. Giambiasi, we worked hard enough to put Nimes in the connectionist community map. I had a wonderful time: many students were attracted to our research centre and many companies were submitting us potential connectionist applications. In 1993, I spent 2 months as an invited professor at LAMI-EPFL, (Switzerland) directed by J.D. Nicoud. I was extremely lucky to be associated to the development of the Khepera robot, the first robot I ever come upon that does not require to be fixed from time to time. During that stay, I met world-class roboticists like F. Mondada (Khepera father and K-Team SA founder), J. Godjevac (author of several books on Fuzzy Logic), and many others. In 1994, the world-economic crisis reached France - budgets were cut drastically – and I joined the University of Marseille 3. There, I continued research in Robot learning with a group of Ph-D students. In particular, we developed a self-organising map implementation of the Q-learning (Q-Kohon) which displays order of magnitude better results than the original matrix implementation. We also worked on the automatic design of optimal reinforcement functions. J.M. Santos, now a Computer Science Professor at the University of Buenos Aires, used this approach and his robot team finished #2 at the 2002 World soccer competition (Korea). In 1997, I joined the CESAR-ORNL (USA) directed by J. Barhen, working in the Cooperative Robots team headed by L. Parker, who was the 2000 recipient of the "Presidential Early Career Award for Scientists and Engineers". I was again extremely lucky. Being part of one the top-5 research centres in the World, I was involved in well funded, but incredibly challenging research projects, like the Urban Robot sponsored by DARPA. In 1999, I moved back to France, and full of energy after my refreshing US stay, I funded a couple of companies in the Internet domain. One was a direct application of my cooperative robots research and offers services that reduce delays when visiting a Web site. In 2001, I joined the University of Provence as a Cognitive Sciences Associate-Professor.

What fired your interest in robotics?

I become interested in Robotics only because I was in need of a test-bed for my artificial neural network models, namely their ability to deal with uncertainty and unpredictability. What better test-bed than a sensor and an actuator acting in the real world.

Is designing of robots right way in exploring aspect of intelligence?

Intelligence is, in my opinion, an ill-posed problem. At least in Robotics since the work of V. Braitenberg (1986), it is evident that we call intelligence is what we do not understand. As long as you don't know how the behaviour is generated, you marvel at the intelligence of the various vehicles, chasing each other's, avoiding pursuit, etc. As soon as the circuits generating the various behaviours are explained to you, the magic disappear – and the intelligence too. What I like with robots is that since they are artefacts, we are able to know exactly what is going one, and therefore we should be able to understand any "intelligent" behaviour they may display.

Could such artefact be intelligent?

To follow on the previous paragraph, robots could only be intelligent if we were unable to explain how they managed to produce such behaviour. Due to the amount of data that they can proceed, it may be very complicated to understand what is going on, but we will know what are the basic mechanisms at work and this could greatly reduce our sense of wonder.

Why should we use neural networks in robot control?

Artificial neural networks allow learning and generalisation. I think that these properties are necessary to deal with real world uncertainty, unpredictability, etc. However, neural networks are not unique in such aspects. They are just a very useful implementation tool when we need to use such properties. Reinforcement learning, fuzzy learning, genetic algorithms and many other approaches exhibit the same properties.

What tips would you give to researchers wanting to use neural networks in design of autonomous systems?

Experience is not something easily shared. For Robotics in particular, I would recommend to try many different models, so that one can really understand the benefits and limitations of each one. In my opinion, the surest way to get stuck into a dead-end, is to work with only one model (in particular back-propagation).

In your opinion, what has been the most exciting advance in neural networks?

Self-organising map [Kohonen, 1984].

Is biological plausibility the key of creating a neural network? Why?

Creating a neural network… I imagine that this question refers to the development of new models of artificial neural networks. If this is the case, then you must remember that a model is always associated with a purpose. There is never anything like a model without a goal. If your goal is to provide insights for understanding Biology, it may be good policy to try to stay as close as possible to biological plausibility. Otherwise, biological plausibility is not necessary.

How successful do you believe neural networks can be applied to mimics biological behaviour?

In theory artificial neural networks can achieved any mapping between situations and actions. Therefore, there is no limit in theory to their mimic abilities. However, reality shows us that today available learning paradigms have limitations. We will certainly improve on these learning paradigms, but it will not be enough. Why? A capable brain is not enough to display an efficient behaviour. Learning is not only a question of memorisation and generalisation; it is also a question of your personal experience, emotion, and motivation. It takes many years to build a competent adult from a child in "good working order". It always makes me wonder when I ear people wanting to provide robots with human capabilities, despite the fact we do not know what are the necessary computing resources of a competent robot. The same people are also in a hurry and imagine they can compress years of education in a single day (or less) of experimentation.

Will insight into how robots interact and cooperate eventually lead us to a better understanding of ourselves?

I think so. My personal experience in cooperative robotics has show me that cooperation may emerged in unsuspected ways – different from what we think applies to the Humans. Moreover, robots, as they interact and cooperate, are powerful simulation tools in Ethology. I imagine that great results will come from this direction in the future.

Is Neural Network research experiencing a renaissance?

I would say that maturity has reached Neural Networks. There is less need for battles and warriors; it is time for the second-generation researchers to leave their marks on the domain.

Can you tell us about any commercial uses of your research?

During my career, I have been deeply involved in applying my research. Today, some neural network applications I have worked on are:

- forecasting next year sales for a big car manufacturer,

- filtering data in a high-furnace application for one of the first steel industries,
- allowing for a graceful degradation of the performance of SONAR antenna,
- reducing by 2 to 5 the delays when visiting a Web site.

If I'm a student thinking about a career designing and building robots, what can I do now to prepare?

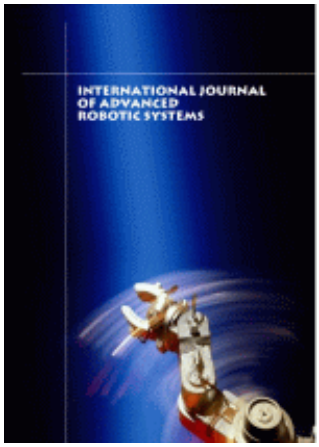
You must be fluent in computer programming, have good notions of microelectronics (sensors, actuators), and be ready to accumulate personal experience in developing applications involving interactions with the "real" world. Notions of Neurosciences and Psychology would be a big plus.

What are the most promising research areas?

I think LEARNING is the key to robotics success. Robots are particularly appropriate to task in unknown environments, therefore our inability to fully model and predict must be taken into account – learning is the solution. The same applies for recovery after failure, cooperation between robots, etc…

If you can start again what would you study now?

At least for me, it is quite impossible to know what knowledge I am missing. All I can say is that I try to complete my knowledge as soon as I identify a lack in my understanding. It is never too late to learn, but remember that between the knowledge acquisition and its application there can be decades!



At the end, what do you think about our journal as an idea to support the research of young scientists?

In my opinion, any scientist under 40 should be considered a young scientist. Usually, editorial responsibilities are given too more mature researchers that do not necessary share the same vision of Research and Science. It is a good idea to have specifically targeted this audience.